REMARKS

Formalities

Applicant appreciates:

The Examiner returning initialed PTO/SB/08 dated March 15, 2004; and

Accepting the drawings,

Applicant would appreciate the Examiner **acknowledging receipt of the priority document** filed March 15, 2004.

The Prior Art

US Publication 2003/0183160 Fujikura et al (Fujikura); US Patent 6,736,894 Kawahara et al (Kawahara).

The Rejection

Claims 1-8, all active claims, were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fujikura in combination with Kawahara.

The Examiner's reading of the prior art and application of the prior art to the claims herein are set forth in the Action, and will not be repeated here except as necessary to an understanding of Applicant's traversal which is now presented.

Traversal

As described in the specification at page 6, the III-V nitride semiconductor substrate of the present invention was obtained based on the following findings:

(a) the surface roughening of a III-V nitride semiconductor substrate by thermal cleaning depends not only on the conditions of thermal cleaning, but also on the characteristics

of a III-V nitride semiconductor substrate *per se*, such as the ease of decomposition of a crystal, etc., and depends particularly on both the dislocation density on the surface of a III-V nitride semiconductor substrate and on the concentration of hydrogen atoms existing in a crystal as impurities; therefore,

(b) when the product of the dislocation density and the concentration of hydrogen atoms is used as an index of the ease of thermal decomposition of a GaN crystal and such product ([H]x[D])is reduced to a predetermined level or less, the resultant III-V nitride semiconductor substrate can be provided with excellent thermal stability to substantially completely suppress surface roughness due to thermal cleaning (see page 6, lines 5-16 of the specification).

Claim 1 of the present application nicely reflects the above concept regarding the product of [H]- the concentration of hydrogen atoms in a surface portion of the single crystal of the III-V nitride semiconductor substrate- and [D] - the dislocation density on the single crystal surface.

Thus, one major distinguishing feature of the claimed invention lies in the **product** of [H] and [D] being 1×10^{25} or less, wherein [H] represents the concentration of hydrogen atoms (the number of hydrogen atoms per cm^3) in a surface portion of the single crystal and [D] represents a dislocation density (the number of dislocations per cm^2) on a single crystal surface, which enables one to achieve excellent thermal stability (see page 23, line 26 to page 24, line 2 of the specification).

In contrast, Fujikura teaches controlling the hydrogen concentration in the crystal-growing atmosphere in the steps of:

(b) forming a nitride semiconductor island structure having a plurality of facets inclined relative to the surface of the substrate with fine crystal particles as nuclei; and

(c) causing the nitride semiconductor island structure to grow in a direction parallel with a surface of the substrate to merge a plurality of the nitride semiconductor island structures with each other, thereby making it possible to achieve crystal growth of the nitride semiconductor with a reduced dislocation density which is lower than the conventional level (see Paragraph [0062]; Paragraphs [0062] and [0064] in view of Paragraphs [0042] and [0043]; and Fig. 7 of Fujikura).

Applicant respectfully submits that what is lacking to support the rejection the Examiner has posed is any teaching in the prior art of any concentration of hydrogen atoms (the number of hydrogen atoms per cm^3 **in a surface portion of the single crystal**, any teaching of the importance of the relationship between the product of [H] and [D], and, importantly, any teaching of the relationship between the hydrogen concentration in the crystal-growing atmosphere and the **hydrogen concentration in a surface portion** of a single crystal as claimed in the present application. Lacking any teaching or suggestion of these parameters, Applicants respectfully submit that the rejection over Fujikura in combination of Kawahara is flawed, and should be withdrawn.

Fujikura merely teaches the hydrogen concentration in the crystal-growing atmosphere. It appears that the Examiner is interpreting this teaching in Fujikura as corresponding to the hydrogen concentration in a surface portion of the single crystal as claimed herein. Applicant submits this to be error.

That is, "the hydrogen concentrations in the crystal-growing atmosphere" is completely different from "the hydrogen concentration in a surface portion of the single crystal" and the hydrogen concentration in a surface portion of the single crystal could never be the same as the hydrogen concentration in the crystal growing atmosphere.

In this regard, Applicant notes that there certainly is a tendency that the higher the hydrogen concentration in the crystal growing atmosphere, the higher the hydrogen concentration in the growing single crystal. However, even if the hydrogen concentration in the crystal-growth atmosphere is lower, the hydrogen concentration in the growing single crystal at certain times is not lower. For instance, when the single crystal growth temperature is not sufficiently high, there occurs no decomposition of trimethyl gallium (TMG) and NH_3 as source gases, whereby even if the hydrogen concentration in the crystal-growing atmosphere is low, incorporation of the hydrogen derived from undecomposed source gases occurs.

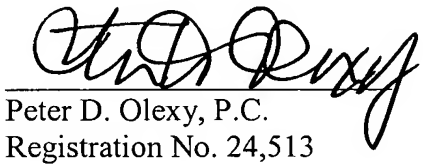
Since Fujikura does not contain any teaching or suggestion regarding the hydrogen concentration in the single crystal obtained, Applicant respectfully submits that there is no motivation for one of ordinary skill in the art to consider controlling the hydrogen concentration in the single crystal obtained, and certainly no motivation to control the product of [H] and [D] nor any appreciation that product is a result effective parameter. Where a parameter is not recognized to be a result-effective variable, in that case optimization of that parameter, (if this is the Examiner's position), is not obvious. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977); *In re Yates*, 663 F.2d 1054 , 211 USPQ 1149 (CCPA 1981); *Ex parte Petersen*, 228 USPQ 217 (Bd. Pat. App. & Int. 1985).

With respect to the combination of references, Kawahara is completely silent regarding the hydrogen concentration in the single crystal. Accordingly, Kawahara does not remedy the defects of Fujikura.

With respect to claims 2-6, Applicant submits that the same are patentable in view of their dependency from claim 1, and take a similar position with respect to claims 7 and 8.

Withdrawal of all rejections and allowance is requested.

Respectfully submitted,



Peter D. Olexy, P.C.
Registration No. 24,513

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

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